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$$y = \frac{b \cos \alpha (16 a \sin \beta + 3 \pi b \cos \alpha \cos \beta)}{4(4b \cos \alpha \cos \beta + 3 \pi a \sin \beta)}$$

The distance of the center of pressure below the surface of the water is

$$\frac{b \cos \alpha \cos \beta (16 a \sin \beta + 3 \pi b \cos \alpha \cos \beta) + a \sin \beta (16 b \cos \alpha \cos \beta + 15 a \pi \sin \beta)}{4(4b \cos \alpha \cos \beta + 3 \pi a \sin \beta)}$$

$$= \frac{32 a b \sin \beta \cos \beta \cos \alpha + 3 \pi b^2 \cos^2 \alpha \cos^2 \beta + 15 \pi a^2 \sin^2 \beta}{4(4b \cos \alpha \cos \beta + 3 \pi a \sin \beta)}.$$

Also solved by S. G. Barton.

239. Proposed by J. G. ROSE, B. A. (Oxon), Mt. Angel College, Oregon.

A uniform bar of length $2a$ is placed in a sloping position, its lower end on the ground (coefficient of friction being μ), its upper end in the air, the bar being supported by a rough fixed peg (coefficient of friction μ'), against which it rests. If h is the height of the peg from the ground, and if θ be the angle the bar makes with the horizon, when on the point of slipping, prove that θ is to be found from the equation

$$\sin \theta \cos \theta [(\mu - \mu') \cos \theta + \sin \theta (1 + \mu \mu')] = \mu h/a.$$

Solution by S. G. BARTON, Ph. D., Clarkson School of Technology, Potsdam, N. Y.

Let R and R' be the pressures on the ground and peg, respectively, and W the weight. Then resolving the forces vertically and horizontally, and taking moments about the point on the ground, we have the three equations:

$$(1) \quad W = R + R' (\cos \theta + \mu' \sin \theta),$$

$$(2) \quad \mu R + R' (\mu' \cos \theta - \sin \theta) = 0,$$

$$(3) \quad R' h \csc \theta = W a \cos \theta, \text{ or } W = \frac{R' h}{a \sin \theta \cos \theta}.$$

Substitute this value of W in (1), multiply the equation by μ and subtract (3) to eliminate R' , and we have

$$\mu \cos \theta + \mu \mu' \sin \theta - \frac{\mu h}{a \sin \theta \cos \theta} - \mu' \cos \theta + \sin \theta = 0.$$

$$\text{Whence, } \sin \theta \cos \theta [(\mu - \mu') \cos \theta + \sin \theta (1 + \mu \mu')] = \mu (h/a).$$

Also solved by G. B. M. Zerr and J. Scheffer.